

# Opportunity prepares for launch

*Opportunity, the second Mars Exploration Rover, required repairs and will launch no earlier than July 5.*



The launch of “Opportunity,” the second of JPL’s twin Mars Exploration Rovers, has been postponed to no earlier than Saturday, July 5.

NASA decided on Monday, June 30 to take additional time to perform tests on the process used to bond the cork insulation to the surface of the Delta II launch vehicle. These tests were scheduled to be completed late Wednesday, July 2.

The launch times on July 5 are 7:51 p.m. and 8:34 p.m. PDT.

NASA engineers inspected the first stage of the Delta vehicle after a June 28 attempt to launch Opportunity, and found that a lower band of cork insulation that was removed and replaced had limited areas that debonded from the surface of the vehicle.

NASA announced Sunday, June 29 that sections of this band, approximately 10 percent of the

circumference, would be reinstalled.

Following its scheduled Jan. 25, 2004 landing in Meridiani Planum, Opportunity will join its twin, Spirit, in a quest to understand the role of water on Mars. Plans call for each rover to operate for at least three months.

Spirit, which was launched June 10, performed its first trajectory correction maneuver June 20.

Following commands from the Mars Exploration Rover flight team at JPL, Spirit first performed a calibration and check of its eight thrusters, then fired the thrusters to fine-tune its flight path toward Mars.

The main burn had two components. Thrusters that accelerate the rotating spacecraft along the direction of the rotation axis burned steadily for about 28 minutes. Then, thrusters that

accelerate the spacecraft in a direction perpendicular to the rotation axis fired in pulses timed to the spacecraft’s rotation rate—with 264 pulses totaling about 22 minutes of burn time. The total maneuver increased Spirit’s speed by 14.3 meters per second (32 mph).

At the end of the trajectory correction, Spirit performed an attitude turn that adjusted its orientation in space to maintain the optimal combination of facing its solar array toward the Sun and pointing its low-gain antenna toward Earth. All systems on the spacecraft are in good health.

Spirit’s next trajectory correction maneuver is scheduled for Aug. 1 and its next attitude turn for July 22.

Spirit will arrive at Mars on Jan. 4, 2004, Universal Time (evening of Jan. 3, 2004, Eastern and Pacific times).

# Odyssey orbiter reveals Mars’ icy character

By Guy Webster

*In winter months, Mars’ icy soil is covered by a thick layer of carbon dioxide (“dry ice”) frost, obscuring the water ice signature. As the layer dissipates in the spring and summer, the water ice becomes ‘visible’ to the neutron and gamma ray detectors onboard Odyssey. Left image mosaic shows the northern hemisphere of Mars as seen by the Viking orbiter. The second image shows the concentration of water ice (in blue) observed by Odyssey during the northern winter, when much of it is buried by carbon dioxide frost. Third image shows the water ice that is revealed during the Martian summer.*

JPL’s Mars Odyssey spacecraft is revealing new details about the intriguing, dynamic character of the frozen layers now known to dominate the high northern latitudes of Mars. The implications have a bearing on science strategies for future missions in the search of habitats.

Odyssey’s neutron and gamma ray sensors tracked seasonal changes as layers of “dry ice” (carbon-dioxide frost or snow) accumulated during northern Mars’ winter and then dissipated in the spring, exposing a soil layer rich in water ice, the Martian counterpart to permafrost. Researchers used measurements of Martian neutrons, combined with height measurements from the laser altimeter on another JPL spacecraft, Mars Global Surveyor, to monitor the amount of dry ice during the northern winter and spring seasons.

“Once the carbon-dioxide layer disappears, we see even more water ice in northern latitudes than Odyssey found last year in southern latitudes,” said Odyssey’s Dr. Igor Mitrofanov of the Russian Space Research Institute, Moscow, lead author of a paper in the June 27 issue of the journal Science. “In some places, the water-ice content is more than 90 percent by volume.” Mitrofanov and co-authors used the changing nature of the relief of these regions, measured more than two years ago by the Global Surveyor’s laser altimeter science team, to explore the implications of the changes.

Odyssey’s trio of instruments, the gamma ray spectrometer suite, can identify elements in the top meter (3 feet) or so of Mars’ surface. Mars Global Surveyor’s laser altimeter is precise enough to monitor meter-scale changes in the thickness of the seasonal frost, which can accumulate to depths greater than a meter. The new findings show a correlation in the springtime between Odyssey’s detection of dissipating carbon dioxide in latitudes poleward of 65 degrees north and Global Surveyor’s measurement of the thinning of the frost layer in prior years.

“Odyssey’s high-energy neutron detector allows us to measure the thickness of carbon-dioxide at lower latitudes, where Global Surveyor’s altimeter does not have enough sensitivity,” Mitrofanov said. “On the

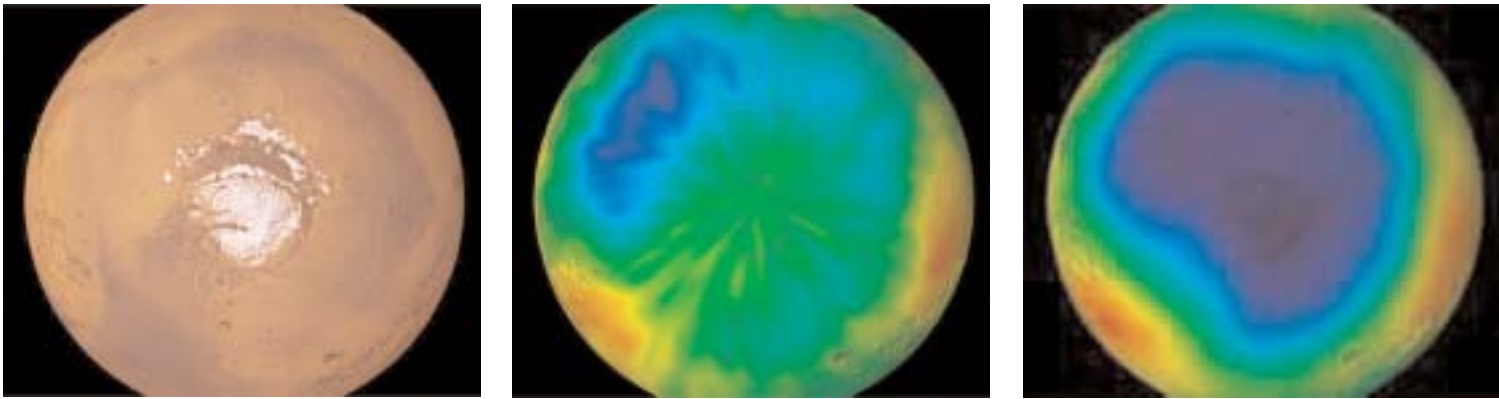
other hand, the neutron detector loses sensitivity to measure carbon-dioxide thickness greater than 1 meter (3 feet), where the altimeter obtained reliable data. Working together, we can examine the whole range of dry ice snow accumulations.”

“The synergy between the measurements from our two ‘eyes in the skies of Mars’ has enabled these new findings about the nature of near-surface frozen materials, and suggests compelling places to visit in future missions in order to understand habitats on Mars,” said Dr. Jim Garvin, NASA’s lead scientist for Mars exploration.

Another report, to be published in the Journal of Geophysical Research-Planets, combines measurements from Odyssey and Global Surveyor to provide indications of how densely the winter layer of carbon-dioxide frost or snow is packed at northern latitudes greater than 85 degrees. The Odyssey data are used to estimate the mass of the deposit, which can then be compared with the thickness to obtain a density. The dry ice layer appears to have a fluffy texture, like freshly fallen snow, according to the report by Dr. William Feldman of Los Alamos National Laboratory, N.M., and 11 co-authors. The study also found once the dry ice disappears, the remaining surface near the pole is composed almost entirely of water ice.

“Mars is constantly changing,” said Dr. Jeffrey Plaut, Mars Odyssey project scientist at JPL. “With Mars Odyssey, we plan to examine these dynamics through additional seasons, to watch how the winter accumulations of carbon dioxide on each pole interact with the atmosphere in the current climate regime.”

Mitrofanov’s co-authors include researchers at the Institute for Space Research, Russian Academy of Science, Moscow; Massachusetts Institute of Technology; NASA Headquarters, Washington, D.C.; Goddard Space Flight Center, Greenbelt, Md.; and TechSource, Santa Fe, N.M. Feldman’s co-authors include researchers at New Mexico State University; Cornell University, Ithaca, N.Y.; and Observatoire Midi-Pyrenees, Toulouse, France.





# News Briefs

### Stardust trajectory modified

JPL's Stardust spacecraft on June 18 successfully completed the mission's third deep-space maneuver. This critical maneuver modified the spacecraft's trajectory, placing it on a path to encounter and collect dust samples from comet Wild 2 in January 2004.

Stardust fired its eight, 4.4-newton (1-pound) thrusters for 1,456 seconds, changing the comet sampler's speed by 34.4 meters per second (77 mph).

"It was a textbook maneuver," said JPL's ROBERT RYAN, Stardust's mission manager. "This was the last big burn we will have prior to our encounter with Wild 2, and it looks very accurate."

Stardust has traveled more than 2.9 billion kilometers (1.8 billion miles) since its February 1999 launch. In January 2004, Stardust will fly through the halo of dust that surrounds the nucleus of comet Wild 2. The spacecraft will return to Earth in January 2006 to make a soft landing at the U.S. Air Force Utah Test and Training Range. Its sample return capsule, holding microscopic particles of comet and

interstellar dust, will be taken to the planetary material curatorial facility at Johnson Space Center for examination.

### Women's Club offers kids' activities

The Caltech Women's Club is sponsoring two summertime activities for children from 10 a.m to noon at Tournament Park in Pasadena.

Preschool Playgroup for ages 1-4 is held Tuesdays. The group offers crafts, song and story time, free play and exploratory learning, and also offers a supportive environment for parents and caregivers to observe and interact with their child in learning and at play. For more information, contact JULIA KENNEFICK at (626) 792-7808 or julia@astro.caltech.edu.

Wednesdays in the Park offers conversation and camaraderie for grownups and playtime for infants through school-age children. This is a great way to meet people and share practical information about services and activities available for families. For more information, contact KATIE CLARK at (626) 403-7163 or ktclark@caltech.edu.

It only skippered the seas of space for a mere three months, but just as Gilligan's "three-hour tour" has continued on in syndication for decades, a salty satellite launched to study the oceans 25 years ago last month by JPL is living on through the many missions it has spawned.

Seasat's tale began in the 1970s when a group of engineers and scientists at JPL began work on an experimental satellite to study Earth and its seas, using technologies being developed to study other planets. The satellite's trip started from the not-so-tropic port of Vandenberg Air Force Base on June 26, 1978, aboard an Atlas-Agena rocket. The five "passengers" that set sail that day aboard Seasat included three prototype radar instruments and two radiometers.

Seasat's "weather" got rough 106 days later, when a malfunction unexpectedly ended the mission. Yet during its brief life Seasat collected more information about the oceans than had been acquired in the previous 100 years of shipboard research. It established satellite oceanography and proved the viability of imaging radar for studying our planet. Most importantly, it fathered many subsequent Earth remote sensing satellites and instruments at JPL and elsewhere that track changes in Earth's oceans, land and ice. Its advances were also subsequently applied to planetary exploration.

"Seasat served to vault Earth science to where it is today, advancing the study of such diverse disciplines as land- and sea-surface topography, ice sheet and land movement, and sea-surface winds," said JPL research scientist Dr. Frank Carsey. "It greatly advanced our understanding of the El Niño and La Niña climate phenomena. It's astonishing to think such a short mission could have such a tremendous impact."

"Seasat had a major impact on future mission planning at NASA and elsewhere," said Seasat sensor manager Tony Spear. "Its prototype radars and altimeter were precursors for many of today's more powerful Earth observation satellites."

Seasat's experimental instruments included a synthetic aperture radar, which provided the first-ever highly detailed

radar images of ocean and land surfaces from space; a radar scatterometer, which measured near-surface wind speed and direction; a radar altimeter, which measured ocean surface and wave heights; and a scanning multichannel microwave radiometer measuring surface temperatures, wind speeds and sea ice cover.

In oceanography, Seasat gave us our first global view of ocean circulation, waves and winds, providing new insights into the links between the ocean and atmosphere that drive our climate. For the first time, the state of an entire ocean could be seen all at once. Seasat's altimeter mapped ocean topography, allowing scientists to determine ocean circulation and heat storage. The data also revealed new information about Earth's gravity field and the topography of the ocean floor. Since Seasat, advanced ocean altimeters on JPL's Topex/Poseidon and Jason missions have been making precise measurements of sea surface height used to study climate phenomena such as El Niño and La Niña. Ocean altimetry has since become part of weather and climate models, ship routing, marine mammal studies, fisheries management and offshore operations.

Seasat's synthetic aperture radar monitored the global surface wave field and revealed a wide spectrum of oceanic and atmospheric phenomena from current boundaries to eddies.

Seasat's scatterometer gave us our first real-time global map of the speed and direction of ocean winds, which drive waves and currents and are the major link between the ocean and atmosphere. The technology was later used on JPL's NASA Scatterometer and is now flying on JPL's Quikscat spacecraft and its SeaWinds instrument on Japan's Midori 2 spacecraft. The data help forecasters predict hurricanes, tropical storms and El Niños.

Seasat's oceanographic mission also studied sea ice and its role in controlling Earth's climate. Its synthetic aperture radar provided the first high-resolution images of sea ice, measuring its movement, deformation, age and thickness. Today, synthetic aperture radar and scatterometers are both used to monitor Earth's ice from space.

Beyond the oceans, Seasat's synthetic aperture radar provided spectacular images of Earth's land surfaces and geology. Seasat data was used to pioneer radar interferometry, which can pinpoint land surface changes such as those created by earthquakes, and to measure land surface topography. Three JPL Shuttle Imaging Radar experiments flew on the space shuttle in the 1980s and '90s. In 2000, JPL's Shuttle Radar Topography Mission used the technology to create the world's most detailed topographic measurements of more than 80 percent of Earth's land surface. Beyond Earth, the technology was used on JPL's Magellan mission, which mapped 99 percent of the previously hidden surface of Venus, and the Titan radar onboard the JPL-built and managed Cassini orbiter to Saturn.

For more information on Seasat, visit <http://www.jpl.nasa.gov/flash/seasat>.

# Special Events Calendar

### Ongoing Support Groups

**Alcoholics Anonymous**—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

**Caregivers Support Group**—Meets the first Thursday of the month at noon in Building 167-111 (The Wellness Place). Call the Employee Assistance Program at ext. 4-3680.

**Codependents Anonymous**—Meets at noon every Wednesday. For more information, call Occupational Health Services at ext. 4-3319.

**Gay, Lesbian and Bisexual Group**—Meets the first Friday and third Thursday of the month at noon in Building 111-117. For more information, call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

**Parents Group for Children With Special Needs**—Meets the second Thursday of the month at noon in the Wellness Place, Building 167-111.

**Working Parents Support Group**—Meets the third Thursday of the month at noon in Building 167-111. For more information, call the Employee Assistance Program at ext. 4-3680.

### Thursday, July 3

**Caltech Ballroom Dance Club**—Summer tango classes begin an eight-week session in Dabney Lounge from 7:30 to 9 p.m., with practice time afterwards. Beginners are welcome. Cost: \$8 per lesson, \$7 if all lessons are prepaid at the start of the series.

**JPL Gun Club**—Meeting at noon in Building 183-328.

### Tuesday, July 8

**JPL Stamp Club**—Meeting at noon in Building 183-328.

### Tues.-Wed., July 8-9

**Investment Advice**—TIAA/CREF representatives will be available for one-on-one counseling. For an appointment, call (877) 209-3140, ext. 2614, or visit <http://www.tiaa-cref.com>.

### Wednesday, July 9

**JPL Amateur Radio Club**—Meeting at noon in Building 238-543.

**JPL Toastmasters Club**—Meeting at 5 p.m. in the 167 conference room. Call Debbie Llata at ext. 3-3690 for information.

### Thursday, July 17

"Staying on Track in a Market Downturn"—Scott Budde, TIAA/CREF's director of equity portfolio analytics, will appear in the 180-101 conference room from 11 a.m. to 12:30 p.m. to address concerns about market volatility and ways to avoid overreacting to it. Areas of discussion will include initial reactions to market fluctuations, when and what to act on, and positive opportunities during down markets. He will also review some of the new tax laws. Seating is limited. Register for the seminar by calling Shelia Kowalski at (877) 209-3140, ext. 2623.

### Thu.-Fri., July 17-18

**Von Kármán Lecture Series**—Robert Hogg, a robotics engineer in JPL's Mobility Systems Concept Development Section, and Brett Kennedy, task manager for the Limbed Excursion Mobile Utility Robot, will present "Searching and Crawling: A Few JPL Research Robots" at 7 p.m. Thursday in von Kármán Auditorium and Friday in Pasadena City College's Vosloh Forum, 1570 E. Colorado Blvd. Thursday's lecture will be webcast at <http://www.jpl.nasa.gov/events/lectures/jul03.html>. For more information, call Public Services at ext. 4-0112.

### Friday, July 18

**TIAA/CREF Enrollment Meeting**—This workshop at noon in Trailer 1720-137 is designed to assist employees newly eligible for the retirement plan with selection of investment options and the completion of enrollment forms.

### Ongoing

The Social Security representative will no longer offer one-on-one counseling appointments on Lab. Call the Benefits Office at ext. 4-3760 to arrange a telephone counseling appointment.

# Bon appetit!



*Dedicating the newly remodeled 167 cafeteria are, from left, Fred McNutt, chief financial officer and director for Business Operations and Human Resources; Andre Mallie, manager of Caltech Dining Services; Deputy Director Gene Tattini; and Nancy Kapell of JPL's Employee Services and Recognition Group.*

## This month in aeronautics and astronautics history

- 7.26.63** **40 years ago** • Syncom 2, the first geosynchronous satellite, was launched.
- 7.28.73** **30 years ago** • NASA's Skylab 3 was launched. The mission would continue for more than 59 days, completing 858 Earth orbits.
- 7.04.97** **6 years ago** • Cushioned by airbags, JPL's Mars Pathfinder spacecraft landed successfully in an ancient flood plain in Mars' northern hemisphere known as Ares Vallis.
- 7.21.98** **5 years ago** • JPL's Galileo spacecraft executed its Europa 16 flyby.



Dutch Slager / JPL Photolab



*JPL Director Dr. Charles Elachi, left, chats with fellow SeaSat veterans Tony Spear, John Gerpheide and Ted Pounder during the mission's 25th anniversary celebration in June.*

Bob Brown / JPL Photolab



# ‘One NASA’ responds to Columbia recovery



This article, the fifth in a series that describes how NASA centers are realizing

the ‘One NASA’ goal, was provided by the Johnson Space Center.



*NASA Administrator Sean O'Keefe (left); astronaut John Casper, director of NASA's Safety, Reliability, and Quality Assurance Office; and David Whittle, chairman of the Mishap Investigation Team, discuss the collection and cataloging process of Columbia debris at Barksdale Air Force Base, Shreveport, La.*



*Teams walked very close together to ensure all ground in the search area was covered.*

The NASA family came together as cohesively as it ever has in East Texas this spring as workers from virtually every NASA center helped organize and conduct the search for clues to Columbia's demise. "In all my years with NASA, I have never seen this agency's people band together as effectively as they have in responding to this tragedy," said Jerry Ross, who took turns with fellow astronaut Dom Gorie to coordinate the day-to-day search efforts. "These people worked very long days for weeks at a time away from home without fighting, complaining or shirking their duty. They set an example that our entire country should strive to emulate."

**In all my years with NASA, I have never seen this agency's people band together as effectively as they have in responding to this tragedy.**

Based in Lufkin, Corsicana, Palestine, Nacogdoches and Hemphill, Texas, as well as Shreveport, La., employees from NASA and its contractors worked shoulder-to-shoulder with friends from the Federal Emergency Management Agency, Environmental Protection Agency, U.S. Forest Service, Texas Forest Service and others. In all, more than 90 local, state and federal organizations responded to the challenges of searching a 10-mile-wide, 240-mile-long corridor in East Texas and West Louisiana by land, air and water.

They stretched those efforts as far west as the California coast, using ingenious methods to predict where shuttle material might have landed as Columbia broke up during re-entry on February 1.

And then they shipped the pieces back to Kennedy Space Center, where their colleagues began reassembling them and working with the Columbia Accident Investigation Board to determine the cause of the accident. Many of the NASA workers were friends of the seven astronauts lost after their ambitious 16-day science mission. All of those involved, whether they were in Mission Control on that fateful day or had no previous connection to America's space program, dedicated themselves to the cause of "bringing Columbia home."

"While we are saddened by the events that have led to this activity, we are all pleased with the cooperation, coordination, dedication and hard work that are being exhibited," said Johnson Space Center's Allen Flynt, one of three NASA Oversight Managers directing efforts from the Lufkin Command Center. Flynt took turns overseeing the effort with Dave King of Marshall Space Flight Center and Mike Rudolphi of Stennis Space Center. "We're also thankful for the new friendships we've forged as our various centers, agencies, organizations and personnel have come together to perform this difficult task."

As of the start of April, about 30 percent of Columbia, by weight, had been recovered and King predicted that some 43 percent of the shuttle would be recovered by the time the search concludes. Citizens and local officials will be reporting discoveries for months, possibly years to come, and NASA will respond as one to bring them home.

"We owe this to our seven brave colleagues who died on their way home," said JSC's Dave Whittle, who led the initial Mishap Response Team mobilized just minutes after Mission Control declared a contingency and spent time both the Barksdale Air Force Base, La., and Lufkin Command Centers. "We owe this to the children of this world who will pick up the torch and carry it into the future."

## JPL's Kapell aids recovery efforts



*JPL's Nancy Kapell, Boeing's Steven Bradford (left) and an unidentified U.S. Forest Service worker joined the ground search teams.*

When William Readdy, NASA's associate administrator for space flight, asked representatives of the agency's Space Flight Awareness program to help support the Space Shuttle Columbia recovery effort in the spring, Nancy Kapell

of JPL's Employee Services and Recognition Group gladly made the trip to east Texas.

Space Flight Awareness liaisons from five NASA centers as well as from industry partners supported scores of firefighters and search team members from federal and local agencies—as well as the communities in which the searches took place—with outreach efforts that show "NASA is a family," Kapell said.

The 18 Space Flight Awareness members split up into four areas that served as command posts, providing a human face on the Columbia tragedy that helped to maintain morale and motivation among the volunteers and rescue workers. Kapell made weeklong trips in March and April to the Palestine, Texas, area.

"It was a wonderful experience, one I'll remember my whole life," Kapell said.

"The guys out on the line worked 10 hours a day, seven days straight," she added. Add to that the fact that prior to a Palestine warehouse becoming available for camping, they had pitched tents inside a rodeo stadium.

Kapell described how two crews of 10 each would spread out about 10 feet apart, walking slowly and carefully to search a quadrant of land.

"They were working in very tough conditions—the search areas were rural, some containing heavy brush, thick briar and swamp," Kapell said. "The weather ranged from very cold and rainy to sweltering hot. They also had to contend with poisonous spiders, snakes and scorpions."

When Kapell and her counterparts thanked the workers for their heroic efforts with gifts of NASA memorabilia, they in turn said, "No, we thank *you* for allowing us to participate in this," she said.

"They were just thrilled to be able to meet an astronaut, and excited to find out about the space program."

Besides Kapell's representing JPL, Space Flight Awareness representatives' from Marshall Space Flight Center, Johnson Space Center, Kennedy Space Center and Stennis Space Center were on hand. In addition, the Space Flight Awareness program was represented by several NASA industrial partners that make space shuttle components.

The Space Flight Awareness outreach activities included traveling to area elementary and high schools, where an astronaut came along to speak to students.

"The community was very supportive of the rescue effort," Kapell said. "There were a lot of donations from local businesses, and it was wonderful seeing everyone work together on a common goal. This was a good way for us to be ambassadors to the community."





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## Passings

**RONALD BIGELOW**, 65, retired from Section 393, died May 5 at his home in La Crescenta.

Bigelow worked at the Lab from 1974 to 1999. He is survived by his wife, Joyce, sons Kenneth and Kevin, daughter Donna Becker, and five grandchildren.

Memorial services were held May 9 at Forest Lawn in Glendale.

## Retirees

*The following JPL employees retired in June:*

David Elliott, 46 years, Section 354; C. Joy Young, 39 years, Section 243; Joe Foster, 36 years, Section 368; Sandra Dewegeli, 31 years, Section 252; Gregor Edwards, 25 years, Section 245; Marge Marquez, 24 years, Section 387; Albert Kuchler, 22 years, Section 512; Guy Spitale, 20 years, Section 810; Terry Scharton, 16 years, Section 352; John Holbrook, 13 years, Section 387.

## Letters

I wish to thank the ERC for the lovely plant after the death of my father, Jerry Laborde. I also thank my coworkers for their support during his illness. My father met many of you when visiting JPL over the years. JPL's most famous images adorned his office, and he could tell the story behind each one. He kept his group of international colleagues up-to-date on JPL missions. A successful engineer and manager, he thought that NASA saved the impossible jobs for JPL. The work we do here, and his connection to it, made him proud and brought him great pleasure. I am glad we were able to give him that.

Greg LaBorde

My family and I are so grateful for your many expressions of sympathy and flowers following the recent death of my son, Christopher. Your kind words and deeds have been a great source of comfort to us.

Sincerely, Marion Stein

I wish to thank my friends at JPL for their prayers and thoughtfulness on the passing of my father, Chuck. And thank you, JPL, for the beautiful plant.

Mark Koehler

I would like to extend my heartfelt thanks to all my colleagues here at the Lab who sent their condolences and sympathies through comforting words, flowers and plants to me and my family on the recent passing of my mother. They lifted our spirits and confirmed my belief that my family is part of the larger JPL family. Thanks to you all for your kind thoughts and best wishes.

Kris Koliwad

## Classifieds

### For Sale

AQUARIUM, 35-gal., glass Eclipse tank with hood, light, heater, air pump, filter, no stand, \$75/obo. 626/836-4960.  
ARMCHAIR, English antique, \$500; AREA RUG, gray & peach, 6 x 9, \$150; CHINESE FAN, large and decorative, golden, 68 x 40, \$75; DESK, glass top, modern design, 30 x 63, \$150; KITCHEN TABLE, wood, 30 x 54, \$50; CROSS COUNTRY SKIS, Fisher Crown, 1.90, as new, \$90; sculptures, Lalique; framed prints, bookcases and more. 310/278-4387.  
ARMOIRE, Rustic Pine, 39"L 25"W 57"H, exc. cond., great for TV or storage, \$300/obo. 249-0528.  
ART, R.C. Gorman signed print, "Woman in Orange," circa 1977, call for e-photo; AROMATHERAPY SPHERE, by Body Basics, new, \$15. 626/398-4960.  
ART WORK, Salvador Dali print "The Quest," 58 of 300, aquatint hand-colored etching, printed in 1981, appraised at \$1,400 in Feb. 1986, e-mail picture available, sell for \$2,500/obo. 661/290-2892.  
BASS, Fender Squire2 Precision, black with white pick guard, hard case included, Peavey TKO bass amp, Scorpion equipped, both in exc. cond., \$200/bass, \$100/amp. 687-3766.  
BUNKBED, Ikea, "Gutvik," solid pine, lacquered, hardly used, \$125. 395-6804, leave msg.

CARD SHUFFLER, Johnson, collectible, all-metal construction with the exception of the friction wheels which drive the cards and the carved-wood dowel handles, stands ~6" handle-high, and ~9" by 6", flanges and handle inclusive, \$35; PORT REPLICATOR, for IBM Thinkpad, works with T20, T21, A20, A21, or X, R series, like new, \$85; DIET TAPES, Jenny Craig, set of 14, \$50. 790-3899.  
CHARGER/CRADLE for Handspring PDA, extra cradle for home or work for your PDA, \$25. 626/395-2590, Mike.  
CHESS COMPUTER, Saitek Cosmic Touch Screen Travel, endorsed by Kasperov, small, electronic hand-held LCD with touch sensitive screen, brand new, in blister pack, sells on Amazon.com for \$59.99 and at Sharper-image.com for \$99.95, will sell for \$50/even. 323/842-2042, Zack.  
CLOTHING, Jones of New York 2 pc./jacket & slacks, fully lined and slash pockets, new with tags, size 12, dark olive, retail \$200+, \$95/obo; 2 pc./jacket & slacks, Rena Rowan for Saville, white, lined, size 14, never worn; pockets still stitched, \$35/obo. 626/398-4960.  
COFFEE MAKER, Braun, 10-cups, white/black, like new, \$30/obo. 626/791-6101.  
COFFEE TABLE, brown/black modern Yin-Yang design, \$25. 626/570-1769, Brian.  
COFFEE TABLES, 2, antique gold ornate pedestal, w/cream marble tops, 24" diameter, good cond., 60.s, \$50/each. 249-1523.  
COMPUTER DESK, white, 66" long with 2 file drawers, supplies cabinet, & keyboard drawer, exc. condition, \$100/obo. 790-5024.  
DESK, cherry, Queen Anne legs, 3 drawers, exc. cond., \$120. 626/798-6588.  
DINING ROOM SET, table, leaf and 6 upholstered chairs, \$125. 626/447-6423.  
DINING ROOM TABLE, oak Craftsman/w/4 chairs, \$375; KITCHEN TABLE, oak; glass & wood coffee table, \$75/ea. 626/403-2503.  
DINING SET, 7 piece, 3 ft. x 5 ft., pine with painted accents, exc. cond. 249-0528.  
DVD PLAYER, Progressive Scan Toshiba SD-3750, like new, features: 3:2 digital cinema progressive conversion, enhanced audio mode/ dialogue expander, 540-line output, 4x digital picture zoom, CD/DVD text display for titled discs, plays audio CD, CD-R, CD-RW, DVD, video CD, cheapest price on web is \$199.95, sacrifice for \$100; ORGAN, Yamaha 415 electronic organ w/13 pedals, 3 keyboards, 144 rhythm patterns, \$2,000. 790-3899.  
ENTERTAINMENT CENTER, light oak, lighted glass cabinets, \$300. 661/254-7443.  
EXERCISE MACHINE, Cardioglide, with electronic readouts, like a rowing machine on a bicycle, like new, orig. cost \$160, sell for \$80/obo. 626/794-0572.  
EXERCISER, SportRider, w/monitor for time, reps, calories, vg cond., \$25; ENCYCLOPEDIA Britannica 1993 Sp. Ed, \$225; children's Encyclopedia Britannica \$75. 500-9163, eve.  
EXERCISE STEPPER, Precore, low-impact climber 714/718e, w/owner's manual, good-hardly used cond., \$50/obo. 249-1523.  
FURNITURE: black leather, \$150/pair; stainless steel tubular leather, \$150/pair; love-seat, \$60; entertainment center, \$75; cocktail table, 39" octagonal glass, \$100. 957-8221.  
FUTON, queen size, oak frame, with mattress and cover, exc. shape, <http://photos.yahoo.com/bc/aysefranko/1st?.dir=/Futon&.src=ph&.view=for pictures>, \$150/obo. 626/791-0585.  
GOLF CLUBS, women's Ping Eye2, irons 3 through wedge, \$200/obo. 248-1102.  
GUITAR PACKAGE, Fender Stratocaster Squier Series, exc. cond., barely used, red and white, incl. hard shell case, Crate GX-15 amp, 10-ft. Pro Co Music Mover cable, beginners book, and Tremolo Arm Whammy Bar, photo w/ad at JPL Store, \$350/obo. 846-1280, Nancy.  
HOME GYM, Body-Solid EXM-1500S, see at [www.bodysolid.com](http://www.bodysolid.com), \$350. 957-5382.  
HOUSEHOLD ITEMS: washer (a9800) and dryer (dg 9800), Maytag, \$600; lawnmower, Honda HR215SXA, \$300; trimmer, Echo SRM 2100, \$100; blower, Echo PB1000, \$100; chainsaw, McCulloch 16" electric, \$40; pole pruner, \$25; rug, black/white, \$75; aquarium, 60 gal. acrylic, w/stand, \$180; ficus plant, 6' indoor, \$40. 957-8221.  
KARAOKE MACHINE, exc. cond., dual-cass., equalizer, echo, other, \$20; cassettes also avail.; VACUUM, Eureka, 5 yrs. old, Excalibur model, 12 amps, \$15; MICROWAVE, Toshiba, large, works very well, w/orig. microwave cookbook, \$20; pictures avail. 661/263-1795.  
LAWN MOWER, McLane, gasoline, reel type, recently sharpened by shop, \$195; EDGER, gasoline, \$145. 626/585-8213.  
LOFT BED, w/desk, bookshelves, and mattress, Ikea; like-new cond., over \$700 new, matching dresser also avail., best offer. 714/524-5367.  
MOUNTAIN BIKE, Trek 8000, red, good cond., \$500. 626/379-9513.  
MOVING SALE: coffee tables, oak, 4' x 2', \$20; 2' x 1.5', \$15; table, glass & brass, w/ 5 chairs, \$130; dining table, solid oak, w/6 chairs, \$175; desk, steel case, \$15; 2-drawer lateral files, birch, \$75/ea; office/conference chairs, \$40. 952-8163.  
PIANO, Schafer and Sons, great student upright, beautiful brown, exc. cond., bench included, S/N 150899, will provide e.picture upon request, \$865. 909/621-9722. [dk.karmon@verizon.net](mailto:dk.karmon@verizon.net).  
PLAYHOUSE/TENT, Winnie the Pooh, like new, \$15; STATIONARY ENTERTAINER, Kolcraft Rock-It, lots of fun for baby, exc. cond., \$15; pictures available. 661/263-1795.  
SAMPLE CASES, 3, multiple compartment, stacked on wheels, good for clothing samples (e.g. shirts, etc.), light instrumentation, or perhaps drums, \$40/ea. 785-7613.  
SPA COVER, 8' x 8', vinyl, 2 yrs. old, redwood color; exc. cond., \$100. 626/359-7666.  
STROLLER, Spectrum twin side-by-side, \$10. 626/570-1769, Brian.  
TREES: red banana plant 5' tall, \$60/obo; fish tail, 6' tall, \$80 obo; ficus, >10' tall, braided, in 30" plastic pot, \$250/obo; ceram-

ic bowl, gray, 2' diameter with planted geraniums, \$40/obo. 626/791-6101.

### Vehicles / Accessories

CAR ROOF CARRIER SYSTEM, Yakima, two bicycle, 2 x 48" roundbars; 4 double cross towers; 2 upright bicycle carriers with locking arms, extra lock devices and instructions, will provide e.pictures upon request, all for \$155. 909/621-9722 or [dk.karmon@verizon.net](mailto:dk.karmon@verizon.net).  
'80 DATSUN (NISSAN) 280ZX coupe, 5-spd. manual, blue/silver, grand lux. pkg., 139,000 miles, generally gd. cond. but needs some work, orig. owner, best offer. 626/577-8107.  
'90 DODGE Dakota, 4 x 4, automatic, short bed, a/c, \$3,000. 760/868-4788, call Friday, Saturday or Sunday.  
'99 FORD Contour SVT, only 37,900 km, exc. cond. very fast, exc. sound syst., new regist., \$9,600. 626/599-8611.  
'95 FORD Taurus SHO Limited, dark green, automatic, powerful engine, 89K, loaded, leather interior, AM/FM/cassette/CD, sunroof, spoiler, no accidents, \$4,200/obo. 626/780-2427.  
'92 FORD Thunderbird, light blue, 81,365 miles, overall gd cond., requires some mechanical work, idles high, \$3,000/obo. 310/812-0388, day or 310/320-2631, eves, Winona.  
'02 HONDA Civic LX sedan, white, manual transmission, only 8,455 miles, Kenwood 10-disc CD changer, power windows/locks/steering, etc., has extended warranty, \$13,000/obo. 626/441-0150, Danny.  
'98 HONDA Accord, 4-door sedan, automatic, a/c, front and driver airbag, alarm, anti-lock brakes, bucket seats, cassette radio, cruise control, power locks/steering/windows, remote keyless entry, purple, interior gray, good engine, drives well, new brakes, 138,000 mi., \$6,150. 661/253-2053, evenings, or [szia2001us@yahoo.com](mailto:szia2001us@yahoo.com).  
'96 HONDA Civic Dx Hatchback 2 dr., 4-cyl. 1.6 liter, 5 spd. manual, a/c, AM/FM/CD, black ext./ gray int., 135K miles, good cond., great gas mileage, \$3,600. 661/268-8609 or [gldrinas@yahoo.com](mailto:gldrinas@yahoo.com).  
'97 ISUZU pickup, auto, air, 140K mi., \$1,600. 957-3675.  
'94 JEEP Grand Cherokee, 4 x 4, 115K mi., Infinity sound system, running board, roof rack, pwr. seats, 1 owner, recently tuned, excellent cond., \$4,000. 626/441-0150, Danny.  
'88 JEEP Cherokee Chief, red, 4-wheel drive, clean interior and body, 30,000 miles on engine, transmission and transfer case, \$2,800. 626/359-7666.  
'85 KOUNTRY Lite 5th wheel trailer, 30 ft., orig. owner, alum. frame, 13.5K btu a/c, side bath, microwave, new tires & water pump, sleeps 6, exc. cond., kitchen equip. included, \$5,300/obo. 626/963-5727.  
'98 MAZDA MPV, 2-tone hunter green/champagne w/beige interior, keyless entry, AM/FM/ cass/cd, separate front and rear a/c, quad seating for 7, pwr. windows & locks, tilt, cruise, privacy glass, ABS brakes, etc., removable middle and rear seats for large cargo, 76K miles, \$2,500 under blue book, \$7,500/ obo. 714/903-6369.  
'95 NISSAN Pathfinder XE, 4 x 4, V6, loaded, tow package, LoJack, 135K mi., \$5,900. 909/596-9007.  
'92 NISSAN Maxima, burgundy, moon roof, a/c, stereo w/CD, power antennae, dash and car cover, vg cond., \$3,900/obo. 909/225-2323.  
'91 OLDSMOBILE Silhouette minivan, auto, air, leather seats, rebuilt transmission, 145K mi., \$3,500. 957-3675.  
'69 OLDSMOBILE Cutlass convertible, classic "Muscle Car," pwr. steering/windows, orig. Delco AM radio, new top, interior, too many items to mention, red w/black interior, see and drive. 952-1538 or [tlynch41@aol.com](mailto:tlynch41@aol.com).  
'97 TOYOTA Camry 4 dr. LE sedan, white, 4 cylinder, vg cond., automatic, loaded, leather seats, tinted windows, 132K mi., \$6,000/obo. 714/508-7744.  
'91 TOYOTA Corolla SR5, 2 dr., dark blue, am/fm/cassette, 100K mi., runs good, recently smogged and licensed, \$2,500/obo. 249-6565.  
'02 VOLKSWAGEN Jetta, auto, moon roof, 5K mi., power door/windows, heated power mirror, blue, Monsoon sound system, \$13,995. 909/599-3230.

### Wanted

BICYCLE TRAILER KID CARRIER, used to buy, InStep or other similar brand. 626/351-8643.  
FEMALE SOFTBALL PLAYERS, with experience for JPL softball team for Monday nights, please contact Angel at 4-1471 or Rick at 4-5425.  
PERSIAN RUG, used, 6 x 8 or bigger, reddish colors preferred. 626/844-9286.  
SPACE INFORMATION/memorabilia from U.S. & other countries, past & present, for personal use. 790-8523, Marc Rayman.

### Free

CLEAN FILL DIRT, 10 cu. yds. avail., haul as little or as much as you like, near Los Robles/Jackson, Pasa. 626/791-3103, [dtrask6@its.caltech.edu](mailto:dtrask6@its.caltech.edu).  
MEDICAL SUPPLIES: hospital bed, electric wheelchair, walker, etc. 909/860-2192.  
TURNTABLE, BSR, 1974, plays 33 1/3, 78 and 45 rpm, motor slow, needs home with capable tinkerer, parts avail. online. 626/794-1841, Claire.

### Lost & Found

LOST: Medium-to-large black knit wool long-sleeve sweater, zip-up front, V-neck. Ext. 4-1176, Rob.

### For Rent

ARCADIA, 2 bd., 1 ba., front unit of quiet 4 plex, fireplace, a/c, stove, laundry room, all new carpet, blinds, paint and ceiling fans, \$1,085. 909/594-0424.  
BURBANK, 3 bd., 1 ba., with garage, private backyard, walk to shopping, schools,

excellent neighborhood, remodeled kitchen, hardwood floors, f/p. c/a, gardener paid, \$2,150. 952-1538. [tlynch41@aol.com](mailto:tlynch41@aol.com).  
LA CANADA, 1 bd., off-street parking (1 car), ~2 mi JPL, tennis court access, water/gardener/trash included, no pets, single preferred, \$980. 952-1304.  
MONTROSE, charming, small, 2-bd., 1-ba. home, f/place, paneling & hardwood floors in liv/din. rm., lg. fenced yard w/shade & fruit trees, residential neighborhood, avail. 8/1, \$1,325. 248-7499.  
MONTROSE home, 2 bd., 1 ba., extra room, 2-car garage, yard, hardwood floors, fire-place, laundry provided, quiet, 4 min. to JPL, close to shopping areas, \$1,575. 248-5068.  
PASADENA, spacious 2-story condo, 3 bd., 2.5 ba., prestigious community, beaut. interior, bright ktch., prof. landscape, ctrl. air & heat, close to shop., cozy LR w/FP, end unit, frml DR, hdwd. flrs., immac. cond., close to schls. \$1,750. 626/396-9024.  
PASADENA, nice home in Upper Hastings Ranch, 3 bd., den, 2 ba., pool, spa and large yard, overlooking golf course, remodeled kitchen and baths, central air and heat, washer/dryer, refrigerator, 2 fireplaces, 1-year lease required, \$3,200 includes gardener and pool service, avail. 7/15. 626/351-9641.  
ROSEMEAD, rooms, 1 bd., 1 ba., \$400-450, or 2 bd., 1 ba., \$850, JPL discount, share full kitchen, living room with hard floor and fireplace, wash/dry, a/c, yard, quiet, near groceries, shopping centers, and freeway 10 and Rosemead Blvd. 280-7987.  
ROSEMEAD, independent house, 3 bd., 2 ba., JPL discount, full kitchen, living room with hard floor and fire place, wash/dry, a/c, yard, enclosed garage, quiet, near groceries, shopping centers, and freeway 10 and Rosemead Blvd., \$1,450. 280-7987.  
SIERRA MADRE townhouse to share with Caltech alumna, 1,000 sq. ft. apt., large patio, 2 bd., 1.5 ba., quiet street, garage parking, washer/dryer, \$605 + 1/2 utils. 626/355-4838, Heather.  
TUJUNGA, small 1 bd. guesthouse, on secure and priv. 3/4 acre w/lg. trees and city/mtn. view. 15 min./JPL, has storage, W/D, rose garden, patio, fruit trees, and car port, \$875 includes util. 952-7980, Ann.

### Real Estate

ALTADENA, 3 bd., 2 ba., 1,569 sq. ft., living rm., dining rm., fireplace, 7,016 sq. ft. lot, built 1960, \$500,000. 909/489-5536, Ray, [foothillhome@msn.com](mailto:foothillhome@msn.com).  
HAWAII, vacation time share, Kauai, Pono Kai resort, Presidential Suite, \$9,500. 957-3675.  
LAKE TAHOE, timeshare at the Ridge Tahoe, Cascade building, gorgeous 5-star resort; floating week in a 2 bd., 2 ba. with lock-off option (turns your one week into two); indoor recreation complex with pool, weight room, racquetball courts, restaurant and lounge; private gondola connects you to Heavenly Valley Ski Resort, beautiful winter and summer, \$13,999. 626/339-2204.  
MT. WASHINGTON house, next to Glendale/Pasadena/Eagle Rock/Occidental College, 2,000 sq. ft., large custom 3 bd., 2.5 ba., 2-car garage, lots of storage, exc. Mt. Washington elementary school, 12 min./JPL, canyon view, quiet neighborhood, ask for JPL discount, \$429,000. 626/403 0446.  
PASADENA, single fam. home, built 1980, liv. room, din. rm., family rm., fireplace, kitchen, 4 bd., 2 full ba., laundry area in 2-car attached garage, spacious patio, 1,465 sq. ft., 8,098 sq. ft. lot, central heat/air, \$399,000. 626/794-0572, B. Jetter, or 626/432-4625, Max.  
VAN NUYS' Walnut Gardens, spacious off-st. end unit townhouse; 2 bd. + loft., 1 ba. up-stairs, 1/2 ba. downstairs; vaulted ceilings, skylight, lg. liv. rm., formal dining area, balcony, 2 pools, spa, recreation room, gated parking area; only \$190,000. 822-4000, Carlos.

### Vacation Rentals

BALBOA ISLAND, cute beach apt., fully furn. 2 bd., 1 ba., patio, washer/dryer, parking, sleeps 5, steps to bay, available weekly in July for \$1,200/week. 626/351-9641.  
BIG BEAR LAKEFRONT, luxury townhome, 2 decks, tennis, pool/spa, beautiful master bd. suite, sleeps 6. 949/786-6548.  
CAMBRIA, ocean front house, sleeps up to 4, excellent view. 248-1102.  
HAWAII, Kauai condo, 1 bd., full kitchen, beach in Kapaa, near shops and restaurants, \$575 for 8 days/7 nights. 626/351-1532.  
HAWAII, Maui condo, NW coast, ocean front view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn. phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slps 4, laundry fac., Low Season rate \$105/nite/2, High Season rate \$120/nite/2, \$15/nite/add'l person. 949/348-8047, or [jackandrandy@cox.net](mailto:jackandrandy@cox.net).  
MAMMOTH, Snowcreek, 2 bd., 2 ba., +loft, sleeps 6-8, fully equipped kitchen incl. microwave, D/W, cable TV, VCR, phone, balcony w/view to mtns., Jacuzzi, sauna, streams, fishponds, close to Mammoth Creek, JPL discount. 626/798-9222 or 626/794-0455 or [valerie@gps.caltech.edu](mailto:valerie@gps.caltech.edu).  
OCEANSIDE condo, fully furn., 2 bd., 2 ba., fireplace, full kitchen, quiet, relaxing, beautiful beachside setting, BBQ/pool/spa/game rm., great ocean view, easy walk to pier and restaurants, slps. 8, available weekly or monthly. 909/981-7492, Darlene; [dfhauge@yahoo.com](mailto:dfhauge@yahoo.com).  
OCEANSIDE, on the sand, charming 1-bd. condo, panoramic view, walk to pier & harbor, pool/spa, game rm., sleeps 4. 949/786-6548.  
'01 PACE ARROW 34-foot RV, queen bed/sofa bed/dinette bed, monthly rentals only, you pay insurance & gas, JPL employees only, no smoking or pets, \$4,000 in advance + \$1,000 sec. deposit, [tahoemike@earthlink.net](mailto:tahoemike@earthlink.net). 530/525-7334.  
ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.  
VENTURA beach house, 3 bd., 1 full ba., near Marina Park, with TV, VCR, CD, washer/dryer, enclosed landscaped backyard with covered porch and sun deck, BBQ, short walk to beach on private rd. 248-0521.